



EMI TEST REPORT

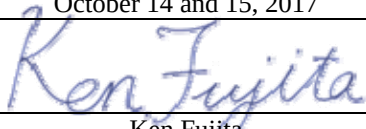
Test Report No. : 11995122H-R1

Applicant : SUBARU CORPORATION
Type of Equipment : Keyless Access System
Model No. : FJ18-1
FCC ID : Y8PFJ18-1
Test regulation : FCC Part 15 Subpart B: 2017 Class B
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. This test report covers EMC technical requirements. It does not cover administrative issues such as Manual or non-EMC test related Requirements. (if applicable)
7. This report is a revised version of 11995122H. 11995122H is replaced with this report.

Date of test: October 14 and 15, 2017

Representative test engineer:


Ken Fujita
Engineer
Consumer Technology Division

Approved by:


Motoya Imura
Engineer
Consumer Technology Division



NVLAP LAB CODE: 200572-0

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 11995122H

[illegible]

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SECTION 1: Customer information

Company Name : SUBARU CORPORATION
Address : 1-1, Subaru-cho, ota-shi, Gunma-ken, 373-8555, Japan
Telephone Number : +81-276-26-3064
Facsimile Number : +81-276-26-3878
Contact Person : Yuji Kobayashi

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment : Keyless Access System
Model No. : FJ18-1
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 12.0 V
Receipt Date of Sample : July 27, 2017
Country of Mass-production : Japan
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

2.2 Product Description

Model No: FJ18-1 (referred to as the EUT in this report) is the Keyless Access System.

General Specification

Clock frequencies in the system : 4.000 MHz (CPU)

Radio Specification

[Transmitter]

Radio Type : Transmitter
Frequency of Operation : 134.2 kHz
Oscillator Frequency : 4.2944 MHz
Type of Modulation : OOK (A1D)
Oscillation circuit : Crystal
Power Supply : DC 12.0 V
Antenna : Antenna (TYPE 1) (*1) (*3) / (TYPE 2) (*2)
*1) Maximum number of this antenna is 2.
*2) Maximum number of this antenna is 5.
Antenna Specification : Ferrite antenna coil

[Receiver]

Radio Type : Receiver
Frequency of Operation : 433.92 MHz
Oscillator frequency : 52.9025 MHz (Crystal)
Intermediate frequency : 10.7 MHz
Type of Modulation : FSK
Type of receiving system : Super-heterodyne
Power Supply : DC 5.0 V
Antenna Type : Internal antenna (Inverted F antenna)

*3) The Antenna (TYPE 1) of this system has variations of model 1 and model 2.

The difference of these variations is only the outer shell, and the test was performed with the representative model 1.

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SECTION 3: Test specification, procedures & results

3.1 Test specification

Test specification : FCC Part 15 Subpart B
FCC Part 15 final revised on November 2, 2017

Title : FCC 47CFR Part15 Radio Frequency Device
Subpart B Unintentional Radiators

* The revision on November 2, 2017, does not affect the test specification applied to the EUT.

3.2 Procedures and results

Item	Test Procedure	Limits	Deviation	Worst margin	Result
Conducted emission	FCC: ANSI C63.4: 2014 7. AC power - line conducted emission measurements	FCC:Part 15 Subpart B 15.107(a)	N/A *1)	N/A	N/A
	IC: RSS-Gen 8.8	IC: RSS-Gen 8.8			
Radiated emission	FCC: ANSI C63.4: 2014 8. Radiated emission measurements	FCC: Part 15 Subpart B 15.109(a)	N/A	15.5 dB 1400.806 MHz Horizontal, AV	Complied
	IC: RSS-Gen 7	IC: RSS-Gen 7.1.2			

*Note: UL Japan, Inc's EMI Work Procedure 13-EM-W0420.

*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.

3.3 Addition to standard

No addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

EMI

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k = 2$

Polarity	Radiated emission (Below 1 GHz)			
	(3 m*)(+/-)		(10 m*)(+/-)	
	30 MHz to 200 MHz	200 MHz to 1000 MHz	30 MHz to 200 MHz	200 MHz to 1000 MHz
Horizontal	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	5.2 dB	6.3 dB	5.0 dB	5.0 dB

Radiated emission (Above 1 GHz)				
(3 m*)(+/-)		(1 m*)(+/-)		(10 m*)(+/-)
1 GHz to 6 GHz	6 GHz to 18 GHz	10 GHz to 26.5 GHz	26.5 GHz to 40 GHz	1 GHz to 18 GHz
5.2 dB	5.5 dB	5.5 dB	5.4 dB	5.5 dB

* Measurement distance

Radiated emission test(3 m)

The data listed in this test report has enough margin, more than the site margin.

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3.5 Test Location

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NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 m x 2.0 m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

SECTION 4: Operation of E.U.T. during testing

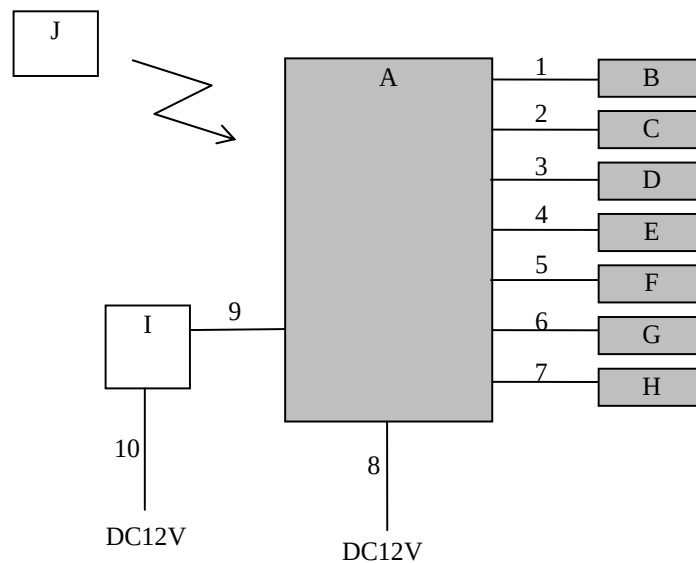
4.1 Operating modes

The mode is used: Receiving mode (Rx) 433.92 MHz

Justification : The system was configured in typical fashion (as a customer would normally use it) for testing.

*It was confirmed by using LED of Jig that the EUT receives the signal from the transmitter (pair of EUT).

4.2 Configuration and peripherals



* Cabling and setup were taken into consideration and test data was taken under worse case conditions.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Smart ECU	-	001	-	EUT
B	Antenna (TYPE 1)_No.1	-	G1087 7F05 2	-	EUT
C	Antenna (TYPE 1)_No.2	-	G1087 7F05 3	-	EUT
D	Antenna (TYPE 2)_No.1	-	8RA-62	-	EUT
E	Antenna (TYPE 2)_No.2	-	8RA-63	-	EUT
F	Antenna (TYPE 2)_No.3	-	8RA-64	-	EUT
G	Antenna (TYPE 2)_No.4	-	8RA-65	-	EUT
H	Antenna (TYPE 2)_No.5	-	8RA-66	-	EUT
I	Switch BOX	-	-	-	-
J	Smart Key	-	001	-	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Antenna (TYPE 1) Cable	3.0	Unshielded	Unshielded	-
2	Antenna (TYPE 1) Cable	3.0	Unshielded	Unshielded	-
3	Antenna (TYPE 2) Cable	3.0	Unshielded	Unshielded	-
4	Antenna (TYPE 2) Cable	3.0	Unshielded	Unshielded	-
5	Antenna (TYPE 2) Cable	3.0	Unshielded	Unshielded	-
6	Antenna (TYPE 2) Cable	3.0	Unshielded	Unshielded	-
7	Antenna (TYPE 2) Cable	3.0	Unshielded	Unshielded	-
8	DC Cable	3.0	Unshielded	Unshielded	-
9	Signal Cable	3.0	Unshielded	Unshielded	-
10	DC Cable	3.0	Unshielded	Unshielded	-

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SECTION 5: Radiated Emission

5.1 Operating environment

Test place : No.3 semi anechoic chamber
Temperature : See data
Humidity : See data

5.2 Test configuration

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.

The EUT was set on the center of the tabletop.

Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.

Photographs of the set up are shown in Appendix 3.

5.3 Test conditions

Frequency range : 30 MHz - 200 MHz (Biconical antenna) / 200 MHz - 1000 MHz (Logperiodic antenna)
1000 MHz - 2000 MHz (Horn antenna)
Test distance : 3 m
EUT position : Table top
EUT operation mode : See Clause 4.1

5.4 Test procedure

The height of the measuring antenna varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

The radiated emission measurements were made with the following detector function of the Test Receiver and the Spectrum Analyzer.

Frequency	Below 1GHz	Above 1GHz *1)
Instrument used	Test Receiver	Test Receiver
IF Bandwidth	QP: BW 120 kHz	PK: BW 1 MHz, CISPR AV: BW 1 MHz

*1) The measurement data was adjusted to a 3 m distance using the following Distance Factor.

Distance Factor: $20 \times \log (4.5 \text{ m} / 3 \text{ m}) = 3.5 \text{ dB}$

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

5.5 Test result

Summary of the test results: Pass

The limit is rounded down to one decimal place.

The test result is rounded off to one or two decimal places, so some differences might be observed.

Date: October 14, 2017
October 15, 2017

Test engineer: Takafumi Noguchi
Ken Fujita

UL Japan, Inc.

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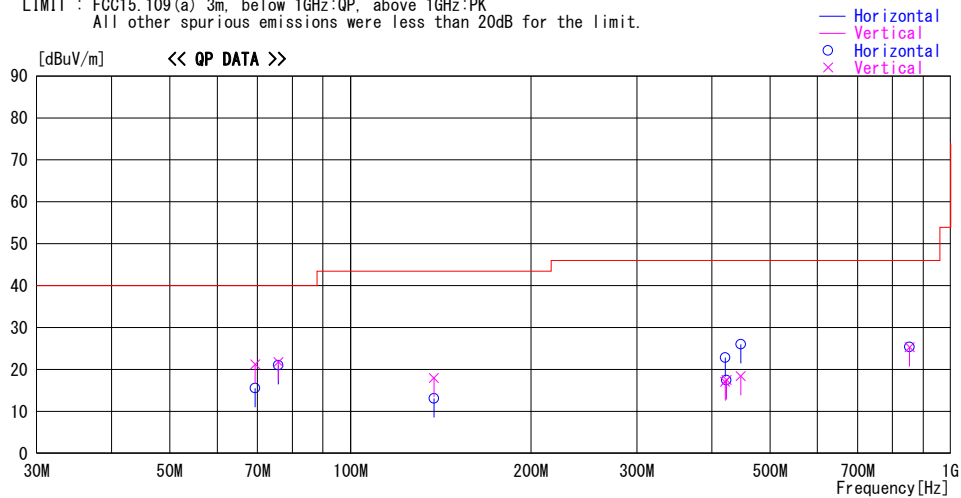
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APPENDIX 1: Test date

Radiated Emission

Report No. 11995122H
Test place Ise EMC Lab
Semi Anechoic Chamber No.3
Date October 14, 2017
Temperature / Humidity 22 deg. C / 68 % RH
Engineer Takafumi Noguchi
(Below 1 GHz)
Mode Receiving mode (Rx) 433.92MHz

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
All other spurious emissions were less than 20dB for the limit.



Frequency	Reading	DET	Antenna Factor	Loss& Gain	Level	Angle	Height	Polar.	Limit	Margin	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
69.387	39.5	QP	6.1	-24.4	21.2	160	100	Vert.	40.0	18.8	
69.387	33.9	QP	6.1	-24.4	15.6	17	275	Hori.	40.0	24.4	
75.864	39.7	QP	6.4	-24.3	21.8	269	100	Vert.	40.0	18.2	
75.864	38.9	QP	6.4	-24.3	21.0	167	228	Hori.	40.0	19.0	
137.781	27.3	QP	14.2	-23.5	18.0	264	100	Vert.	43.5	25.5	
137.781	22.4	QP	14.2	-23.5	13.1	0	100	Hori.	43.5	30.4	
420.857	22.2	QP	16.1	-21.2	17.1	245	100	Vert.	46.0	28.9	
420.857	27.9	QP	16.1	-21.2	22.8	33	100	Hori.	46.0	23.2	
423.220	22.4	QP	16.2	-21.1	17.5	0	100	Vert.	46.0	28.5	
423.220	22.4	QP	16.2	-21.1	17.5	0	100	Hori.	46.0	28.5	
447.010	30.3	QP	16.7	-21.0	26.0	256	100	Hori.	46.0	20.0	
447.010	22.7	QP	16.7	-21.0	18.4	246	100	Vert.	46.0	27.6	
854.246	21.7	QP	21.5	-17.9	25.3	0	100	Vert.	46.0	20.7	
854.246	21.8	QP	21.5	-17.9	25.4	0	100	Hori.	46.0	20.6	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

*The limit is rounded down to one decimal place.

*The test result is rounded off to one or two decimal places, so some differences might be observed.

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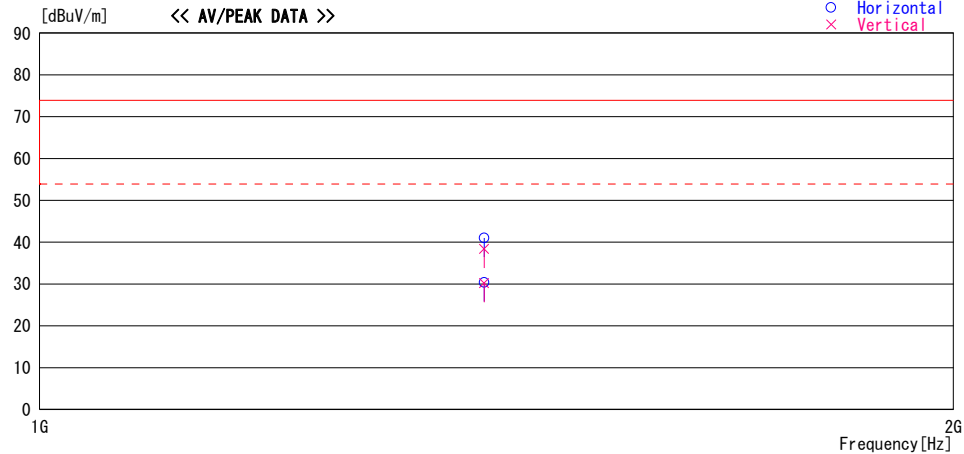
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Radiated Emission

Report No. 11995122H
Test place Ise EMC Lab
Semi Anechoic Chamber No.3
Date October 15, 2017
Temperature / Humidity 22 deg. C / 67 % RH
Engineer Ken Fujita
(Above 1 GHz)
Mode Receiving mode (Rx) 433.92MHz

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit	Margin	Comment
			Factor [dB/m]	Gain [dB]					[dBuV/m]	[dB]	
1400.806	45.1	PK	25.5	-29.6	41.0	0	390	Hori.	73.9	32.9	
1400.806	34.5	AV	25.5	-29.6	30.4	0	390	Hori.	53.9	23.5	
1400.806	42.5	PK	25.5	-29.6	38.4	0	100	Vert.	73.9	35.5	
1400.806	34.3	AV	25.5	-29.6	30.2	0	100	Vert.	53.9	23.7	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN

CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE - GAIN(AMP) + D-factor)

*The limit is rounded down to one decimal place.

*The test result is rounded off to one or two decimal places, so some differences might be observed.

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APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2016/10/20 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2017/01/20 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2017/08/22 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2017/08/22 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2016/11/23 * 12
MLA-22	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	RE	2017/01/26 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2017/07/12 * 12
MAT-98	Attenuator	KEYSIGHT	8491A	MY52462349	RE	2016/12/05 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2017/03/27 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE	2017/01/19 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2017/08/22 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2017/05/22 * 12
MCC-167	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	RE	2017/05/29 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2017/03/21 * 12
MTR-10	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	RE	2017/01/12 * 12

The expiration date of the calibration is the end of the expired month.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test Item:

RE: Radiated emission

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